STEM Learning Package

Time travelling for impact

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If I could somehow know the future,
then now should not be like this time.

Toba Beta

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You are free to the choice that you want, but you are not free from the consequences of that choice. That choice you make today may break or make your future.

Itayi Garande

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Learning intention & student outcomes

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In this Learning Package, students will study concepts that will help them understand cause and effect, in their present and throughout history. Before delving deep into the design challenge, students will know and understand the following concepts:

- Domino and butterfly effect
- Chaos theory
- Pendulum wave re-synchronisation and alignment
- Mapping timelines of cause and effects throughout history
- Human advances through general and sociological periods of time

Design Challenge

Students will study human technological and engineering advances throughout history and examine the impacts (positive and negative) created by human actions.

Students will focus on one negative effect, and track back the initial step that caused it, to then design an alternative sequence of events that avoids the negative implications. They will go back in time to design an intervention strategy that fixes a current problem and present a new outcome visually and in written and narrated forms.

Students will storify their design to create an engaging and clearly positive outcome.

This learning package will enable students to understand the impacts of actions and the power humans have to change of future directions. They will determine and examine what has been a human error in history and re-write the ending by changing and intervening the timeline with a modified action.

They could focus on re-modelling an engineering fail, a human disaster, a current environmental impact or political unrest by first finding the actions that caused them and then intervening in the chain of events.

Students will understand that just like they make hypothetical changes in history, they have the power to make an impact on their futures. They realise that their study isn't just in theory, but they can apply learning in ways that have effects and impacts.

Students learn about the long-reaching impacts of individual actions.

ACARA Learning Areas

Year 8 History

Achievement standards: By the end of Year 8, students recognise and explain patterns of change and continuity over time. They explain the causes and effects of events and developments. They identify the motives and actions of people at the time. Students explain the significance of individuals and groups and how they were influenced by the beliefs and values of their society. They describe different interpretations of the past.

Students sequence events and developments within a chronological framework with reference to periods of time. When researching, students develop questions to frame a historical inquiry. They analyse, select and organise information from primary and secondary sources and use it as evidence to answer inquiry questions.

Students identify and explain different points of view in sources. When interpreting sources, they identify their origin and purpose and distinguish between fact and opinion.

Students develop texts, particularly descriptions and explanations, incorporating analysis. In developing these texts, and organising and presenting their findings, they use historical terms and concepts, evidence identified in sources, and acknowledge their sources of information.

ACARA Learning Areas

Year 8 English

Productive modes (speaking, writing and creating)

Achievement standards: Students understand how the selection of language features can be used for particular purposes and effects. They explain the effectiveness of language choices they make to influence the audience. By combining ideas, images and language features from other texts, students show how ideas can be expressed in new ways.

Students create texts for different purposes, selecting language to influence audience response. They make presentations and contribute actively to class and group discussions, using language patterns for effect.

When creating and editing texts to create specific effects, they take into account intended purposes and the needs and interests of audiences. They demonstrate understanding of grammar, select vocabulary for effect and use accurate spelling and punctuation.

ACARA Learning Areas

Year 8 Science

Achievement standards: Students explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems. They reflect on the implications of these solutions for different groups in society.

Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled.

Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.

The history of science has proved that fundamental research is the lifeblood of individual progress and that the ideas that lead to spectacular advances spring from it.

Edward Victor Appleton

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Nothing has such power to broaden the mind as the ability to investigate systematically and truly all that comes under thy observation in life.

Marcus Aurelius

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Pedagogical/Androgogical/Heutagogical Options

Cross-disciplinary learning package for:

- Enquiry-based Learning
- Project- and Problem-based Learning
- STEM-focused learning design

Provides teachers with resources for delivering the learning intentions against cross-disciplinary ACARA achievement standards.

Teachers are encouraged to provide students with self-directed learning opportunities rather than opting to deliver in traditional teacher-guided modes.

General capabilities

Critical & Creative Thinking

- pose questions
- identify and clarify information and ideas
- organise and process information
- explore ideas

Generating Ideas, Possibilities & Actions

- imagine possibilities and connect ideas
- consider alternatives
- seek solutions and put ideas into action

General capabilities

Reflecting on Thinking & Processes

- think about thinking (metacognition)
- reflect on processes
- transfer knowledge into new contexts

Analysing, Synthesising & Evaluating Reasoning and Procedures

- apply logic and reasoning
- draw conclusions and design a course of action
- evaluate procedures and outcomes

Entrepreneurial skills & dispositions

- Ability to recognise opportunities
- Creating, imagining and innovating
- Thinking and communicating with clarity and precision
- Critical thinking
- Responding with wonderment and awe
- Curiosity towards things around them
- Reflective thinking

Lesson implementation

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It has been said that something as small as the flutter of a butterfly's wing can ultimately cause a typhoon halfway around the world.

Chaos Theory

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The fact that a cloud from a minor volcanic eruption in Iceland – a small disturbance in the complex mechanism of life on the Earth – can bring to a standstill the aerial traffic over an entire continent is a reminder of how, with all its power to transform nature, humankind remains just another species on the planet Earth.

Slavoj Žižek

Activity 1: How connected are we?

Chain reaction: Watch the Domino Chain Reaction video, discuss and come up with other quick examples of how our actions have consequences.

This activity will help students realise that even the smallest actions create a chain of consequences. The intention of this activity is to inspire students to act towards solutions even if they do not see the direct effects.

To demonstrate how interlinked we are, gather your student's attention and just smile! That's it, just smile and wait for a couple of minutes (alternatively, project an image of a smiling person).

Count the number of students who respond with a smile back. This quick exercise demonstrates that our actions (although not always traceable) always have a reaction.

Once you do this quick activity, ask your students to design in groups. They may come up with jokes (evoking laughter as the reaction), or tell a sad story (evoking feelings as a reaction), or even sneeze, scream ‘spider’ or anything that can cause a visible effect/reaction.

Discussion point: can a reaction be stopped?

Imagine you take the next domino to fall out of line before it gets pushed! How can this give us the power to have better outcomes in ‘already pushed’ actions?

Activity 2: The biggest impact is on your closest reach

One small action can be traced to have a global impact, demonstrating the impact an individual can have on, for example, the spread of Covid-19.

Although you now know that one action has a chain of reactions, the first point of effect is always within your reach. Therefore, connection is an important aspect for the transmission of effects from one single action.

Students will look at how ‘Chaos Theory’ can help them understand that they are more connected than they realise.

Watch The Surprising Secret of Synchronisation and then answer the following questions:

- Why do pendulums and metronomes synch?
- How do the fireflies of south-east Asia synchronise their light flashes?

Come up with other examples where 'Chaos Theory' applies, apart from the mentioned mechanical, human, animal and anatomical examples.

Can you find ways you and your peers have synchronised without consciously knowing about it? (such as language, accent, preferred foods etc)

Can you control synchronisation?

For this last question, please carefully watch and follow the Power of the Pentatonic Scale video with the whole class before answering.

History's timeline

Introduce students to historical events, developments and periods before proposing a series of human 'errors' to work on for their design challenge. A range of content from History as a learning area may be added here.

Students study human technological and engineering advances throughout history and examine the impacts (positive and negative) created by human actions.

Students will focus on one negative effect, and track back the initial step that caused it, to then design an alternative sequence of events that avoids the negative implications. They select one of the many technological, human errors throughout history with the aim of understanding exactly what went wrong in order for you to intervene in the history of its timeline. You may intervene with new knowledge humans did not have or with new technology that humans did not have.

Each intervention should showcase a chronological chain of events starting from before the error occurred:

1. **Ponte das Barcas**: History's deadliest bridge collapse occurred during the Peninsular War as the forces of Napoleon attacked the Portuguese city of Porto.
2. **Titanic**: Captain Edward Smith crashes the Titanic into an iceberg
3. **Great Pacific garbage patch (GPGP)**: the largest of the five offshore plastic accumulation zones in the world's oceans.

Task: Create a timeline of the historical event as it is, without any modifications. Explain the sequence of events from prior and post factors, including event details, year and context, technological resources, historical contributors, implications, and repercussions. Focus on the technologically limiting factors that enabled the 'error' to occur. Present your findings to the class before proceeding to undertake the design challenge.

Note: Teachers and students to propose further portions for students to respond to with their designed solutions.

Design challenge

Now that students understand the context around the selected human error, they go back in time to design an intervention strategy that fixes the error and present a new outcome visually and in written and narrated forms. Students storify their design to create an engaging and clearly positive outcome.

What to present:

- Narrate the story of the change you made and how it changes the timeline of events.
- Re-write a new ending based on the changes made to the timeline with your modified action.
- Use graphical and visual representation to demonstrate the technical changes in the scene/context

- Summarise the impacts of your changed actions and how it relates to current changes humans could make in order to change our future directions.
- Explain why the chosen error is in fact a human error in history

Whether you worked on re-modelling an engineering fail, a human disaster, a current environmental impact or political unrest, highlight the knowledge, technology or human advancement that made your change possible.

Bring the timeline as close as possible to the present, explaining the current changes we would have noticed today. Explain how this task shows evidence of the power to make an impact on our futures.

Demonstrate your understanding of the long-reaching impacts of individual actions.

Summarise how your learning isn't theory but can be applied in ways that have effects and impacts.

Content descriptors

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History

Historical Skills

- *Chronology, terms and concepts*: Sequence of historical events, developments and periods (ACHHS148)

  Use historical terms and concepts (ACHHS149)

- *Historical questions and research*: Identify a range of questions about the past to inform a historical inquiry (ACHHS150)

  Identify and locate relevant sources, using ICT and other methods (ACHHS151)

- *Analysis and use of sources*: Identify the origin and purpose of primary and secondary sources (ACHHS152)

  Locate, compare, select and use information from a range of sources as evidence (ACHHS153)

  Draw conclusions about the usefulness of sources (ACHHS154)
- *Perspectives and interpretations*: Identify and describe points of view, attitudes and values in primary and secondary sources (ACHHS155)
- *Explanation and communication*: Develop texts, particularly descriptions and explanations that use evidence from a range of sources that are acknowledged (ACHHS156)

  Use a range of communication forms (oral, graphic, written) and digital technologies (ACHHS157)

English

Historical Skills

- *Language for interaction*: Understand how conventions of speech adopted by communities influence the identities of people in those communities (ACELA1541)

  Understand how rhetorical devices are used to persuade and how different layers of meaning are developed through the use of metaphor, irony and parody (ACELA1542)

- *Text structure and organisation*: Analyse how the text structures and language features of persuasive texts, including media texts, vary according to the medium and mode of communication (ACELA1543)

Understand how cohesion in texts is improved by strengthening the internal structure of paragraphs through the use of examples, quotations and substantiation of claims (ACELA1766)

Understand how coherence is created in complex texts through devices like lexical cohesion, ellipsis, grammatical theme and text connectives (ACELA1809)

Understand the use of punctuation conventions, including colons, semicolons, dashes and brackets in formal and informal texts (ACELA1544)

- *Expressing and developing ideas*: Analyse and examine how effective authors control and use a variety of clause structures, including clauses embedded within the structure of a noun group/phrase or clause (ACELA1545)

  Understand the effect of nominalisation in the writing of informative and persuasive texts (ACELA1546)

Investigate how visual and multimodal texts allude to or draw on other texts or images to enhance and layer meaning (ACELA1548)

Recognise that vocabulary choices contribute to the specificity, abstraction and style of texts (ACELA1547)

Understand how to apply learned knowledge consistently in order to spell accurately and to learn new words including nominalisations (ACELA1549)

Literacy

- *Texts in context*: Analyse and explain how language has evolved over time and how technology and the media have influenced language use and forms of communication (ACELY1729)
- *Interacting with others*: Interpret the stated and implied meanings in spoken texts, and use evidence to support or challenge different perspectives (ACELY1730)

Use interaction skills for identified purposes, using voice and language conventions to suit different situations, selecting vocabulary, modulating voice and using elements such as music, images and sound for specific effects (ACELY1808)

Plan, rehearse and deliver presentations, selecting and sequencing appropriate content, including multimodal elements, to reflect a diversity of viewpoints (ACELY1731)

Interpreting, analysing, evaluating

- Analyse and evaluate the ways that text structures and language features vary according to the purpose of the text and the ways that referenced sources add authority to a text (ACELY1732)
- Apply increasing knowledge of vocabulary, text structures and language features to understand the content of texts (ACELY1733)

- Use comprehension strategies to interpret and evaluate texts by reflecting on the validity of content and the credibility of sources, including finding evidence in the text for the author's point of view (ACELY1734)
- Explore and explain the ways authors combine different modes and media in creating texts, and the impact of these choices on the viewer/listener (ACELY1735)
- *Creating texts*: Create imaginative, informative and persuasive texts that raise issues, report events and advance opinions, using deliberate language and textual choices, and including digital elements as appropriate (ACELY1736)

  Experiment with text structures and language features to refine and clarify ideas to improve the effectiveness of students' own texts (ACELY1810)

  Use a range of software, including word processing programs, to create, edit and publish texts imaginatively (ACELY1738)

Science

Science as a Human Endeavour

- *Nature and development of science*: Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE134)

  Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE226)

- *Use and influence of science*: Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE135)

  People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE136)

Science inquiry skills

- *Questioning and predicting*: Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS139)
- *Processing and analysing data and information*: Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSIS144)

  Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (ACSIS145)

- *Evaluating*: Reflect on scientific investigations including evaluating the quality of the data collected, and identifying improvements (ACSIS146)

  Use scientific knowledge and findings from investigations to evaluate claims based on evidence (ACSIS234)
- *Communicating*: Communicate ideas, findings and evidence-based solutions to problems using scientific language, and representations, using digital technologies as appropriate (ACSIS148)

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